

### Claims

1 1. A method of buffering, during at least a predetermined retention time, a digital  
2 optical signal having a predetermined digital level, comprising:

3 inputting the optical signal to an optical input of a semiconductor laser element; and  
4 injecting an injection current to said semiconductor laser element to establish an  
5 optical gain process in said semiconductor laser element, the injection current having an  
6 amplitude such that said optical gain process and an optical absorption process within  
7 said semiconductor laser element outweigh one another longer than said retention time in  
8 order to keep said digital optical signal on said predetermined digital level during said  
9 retention time.

1 2. The method according to claim 1, further comprising:  
2 outputting said optical signal to an output line by means of an optical output switch  
3 connected between an output of said semiconductor laser element and said output line.

1 3. The method according to claim 1, further comprising the step of, prior to the  
2 inputting step, clearing said semiconductor laser element by turning off said injection  
3 current during a predetermined clearing time period.

1 4. A method of time division multiplexing of a plurality of digital optical signals  
2 each having a predetermined digital level, comprising:

3 inputting each of the optical signals to an optical input of one of a plurality of  
4 semiconductor laser elements;

5 injecting a distinct injection current to each of said semiconductor laser elements to  
6 establish an optical gain process in each of said semiconductor laser elements, each  
7 injection current having an amplitude such that said optical gain process and an optical  
8 absorption process within each of said semiconductor laser elements outweigh one  
9 another longer than a predetermined retention time in order to keep each of said digital  
10 optical signals on each of said predetermined digital levels during said retention time; and

11 consecutively outputting each of said optical signals to one output line in consecutive  
12 time frames by means of a plurality of optical output switches, each one of said plurality  
13 of output switches being connected between an output of one of said semiconductor laser  
14 elements and said output line.

1        5. The method according to claim 4, further comprising the step of, prior to the  
2 inputting step, clearing said semiconductor laser element by turning off said injection  
3 current during a predetermined clearing time period.

1        6. An arrangement for buffering, during at least a predetermined retention time, a  
2 digital optical signal having a predetermined digital level, comprising:

3            a semiconductor laser element with an optical input for receiving the optical signal;  
4 and

5            a current source connected to said semiconductor laser element and arranged to  
6 inject an injection current to said semiconductor laser element to establish an optical gain  
7 process in said semiconductor laser element, the injection current having an amplitude  
8 such that said optical gain process and an optical absorption process within said  
9 semiconductor laser element outweigh one another longer than said retention time in  
10 order to keep said digital optical signal on said predetermined digital level during said  
11 retention time.

1        7. The arrangement according to claim 6, further comprising a controller connected  
2 to said current source to provide a current control signal to said current source to control  
3 an amplitude of said injection current.

1        8. The arrangement according to claim 7, further comprising an optical detector  
2 arranged to detect optical power content of said semiconductor laser element and to  
3 provide a feedback signal to said controller, said controller being arranged to generate  
4 said current control signal in dependence on said feedback signal.

1        9. The arrangement according to claim 8, further comprising an optical output  
2 switch connected between an output of said semiconductor laser element and an output  
3 line, and connected to said controller to receive an output switch control signal to control  
4 outputting said optical signal to said output line.

1        10. The arrangement according to claim 9, further comprising an optical output  
2 directional filter connected between said output of said semiconductor laser element and  
3 said optical output switch.

1        11. The arrangement according to claim 10, further comprising an optical input  
2 switch connected to said input of said semiconductor laser element, and connected to said

3 controller to receive an input switch control signal to control inputting said optical signal  
4 to said semiconductor laser element.

1 12. The arrangement according to claim 11, further comprising an optical input  
2 directional filter connected between said input of said semiconductor laser element and  
3 said optical input switch.

1 13. The arrangement according to claim 11, wherein said controller is arranged for  
2 controlling said current source such that said current source clears said semiconductor  
3 laser element by turning off said injection current during a predetermined clearing time  
4 period prior to switching said digital optical signal to said semiconductor laser element  
5 by said optical input switch.

1 14. An arrangement for time division multiplexing of a plurality of digital optical  
2 signals each having a predetermined digital level, comprising:

3 a plurality of semiconductor laser elements each having an optical input for  
4 receiving one of said optical signals;

5 a current source connected to said semiconductor laser elements for injecting a  
6 distinct injection current to each of said semiconductor laser elements to establish an  
7 optical gain process in each of said semiconductor laser elements, each injection current  
8 having an amplitude such that said optical gain process and an optical absorption process  
9 within each of said semiconductor laser elements outweigh one another longer than a  
10 predetermined retention time in order to keep each of said digital optical signals on each  
11 of said predetermined digital levels during said retention time;

12 a plurality of optical output switches, each one of said plurality of output switches  
13 being connected between an output of one of said semiconductor laser elements and one  
14 output line; and

15 a controller connected to said plurality of optical output switches to control  
16 consecutively outputting each of said optical signals to said output line in consecutive  
17 time frames.